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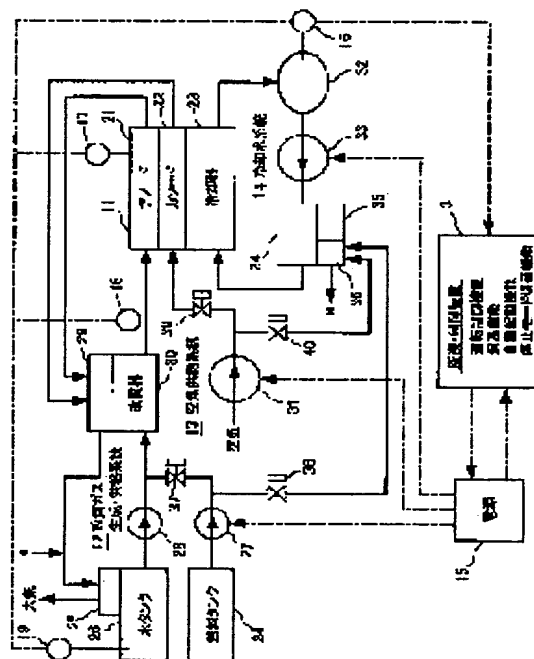
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(54) POWER SUPPLY SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent deterioration or break of system caused by freezing and provide a shortened start time and steady start by having an automatic heat insulation function of a fuel cell unit in stop and storage of the system.

SOLUTION: A power supply system comprises a fuel cell 11, reformed gas generating/supplying system 12, an air supply system 13, a cooling water system 14, a various kind of an auxiliary unit for supplying/circulating and heating arranged within the systems 12-14 and a fuel unit 1 having a power supply 15 for an auxiliary unit and a battery 2 as a power supply, and further comprises temperature detectors 16-19 and a monitoring/controlling unit 3. In stopping and storage of the system, the temperature detectors 16-19 automatically monitors the temperature of at least of the fuel cell body 11 and the cell cooling water. The monitoring/controlling unit 3 issues instruction into the power supply 15 for the auxiliary unit to operate the necessary auxiliary unit and the heat insulation function in the case where a measuring value obtained from the temperature detectors 16-19 is temperature requiring a heat insulation.



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CLAIMS

[Claim(s)]

[Claim 1] the body of a fuel cell, and a original fuel -- reforming -- with reformed gas generation / supply network reformed with a reforming vessel using service water An air supply network, the cooling water network which circulates cell cooling water, and the auxiliary machinery equipment for supply / circulation formed in each network, In the power-source system equipped with the fuel cell equipment which has the auxiliary machinery equipment for heating formed in said reformed gas generation / supply network and the cooling water network, and a power source for auxiliary machinery equipments, and a dc-battery (rechargeable battery) as a power source The thermometric element which checks the temperature of said body of a fuel cell and said cell cooling water automatically at least in halt / storage condition of said power-source system, When the measured value which receives the signal from said thermometric element and is obtained from this signal becomes the temperature which requires incubation The power-source system characterized by having the monitor and control unit which takes out a command to said power source for auxiliary machinery equipments so that the auxiliary machinery equipment according to the object which requires incubation of the auxiliary machinery equipment for said supply / circulation and the auxiliary machinery equipment for said heating may be operated and an incubation function may be operated.

[Claim 2] the fuel tank in which said reformed-gas generation / supply network stores said Hara fuel, and said reforming -- the water tank which stores service water -- an individual exception -- having -- a original fuel and reforming -- it constitutes so that service water may be supplied to a reforming machine according to an individual -- having -- said thermometric element -- the temperature of said body of a fuel cell and said cell cooling water -- adding -- said reforming machine and said reforming -- the power-source system according to claim 1 characterized by to be constituted so that it may check automatically also about the temperature of service water.

[Claim 3] a means by which said reformed gas generation / supply network stores said Hara fuel, and said reforming -- the power-source system according to claim 1, by which the storage tank of the fuel for incubation for having the composite fuel storage tank which unified a means to store service water, and supplying the auxiliary machinery equipment for said heating is characterized by forming said composite fuel storage tank independently.

[Claim 4] A power-source system given in any 1 term of claims 1-3 characterized by making said dc-battery serve a double purpose as said power source for auxiliary machinery equipments.

[Claim 5] It has the starting system which starts said power-source system automatically, and the remaining capacity monitor which supervises the remaining capacity of said dc-battery. Said monitor and control unit By receiving the signal from said remaining capacity monitor, and taking out a command to said starting system, when the remaining capacity obtained from this signal changes into an insufficient condition The power-source system according to claim 4 which said starting system is operated, makes said fuel cell equipment a generation-of-electrical-energy condition, and is characterized by being constituted so that said dc-battery may be made to charge.

[Claim 6] Said monitor and control unit are a power-source system given in any 1 term of claims 1-5 characterized by having the function which can be changed to either of the incubation stop modes when said incubation function does not operate in halt / storage condition of said power-source system, and to which stop mode and an incubation function usually operate automatically.

[Claim 7] Said cooling water network is a power-source system given in any 1 term of claims 1-6 characterized by having a combustion burner as auxiliary machinery equipment for said heating.

[Claim 8] Said cooling water network is a power-source system given in any 1 term of claims 1-6 characterized by having an electric heater as auxiliary machinery equipment for said heating.

[Claim 9] A power-source system given in any 1 term of claims 1-8 characterized by using a source power supply as said power source for auxiliary machinery equipments.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the power-source system which contains a fuel cell especially about the power-source system for supplying power.

[0002]

[Description of the Prior Art] Conventionally, as a power-source system containing a fuel cell, it has a fuel cell and a rechargeable battery as a power source, and the power-source system of the type which charges a rechargeable battery and supplies power from the charged rechargeable battery to a load with a fuel cell is proposed (for example, JP,6-124720,A, JP,10-40931,A, etc.). These power-source systems have the composition of charging the power from a fuel cell at a rechargeable battery, and it is possible to supply power to loads, such as a motor for a drive of an electric vehicle, at stability.

[0003] Moreover, as a fuel cell which uses the above fuel cells and rechargeable batteries for the power-source system used as the power source, application of the fuel cell of various kinds of generation-of-electrical-energy methods is achieved. Since the fuel cell of the type which uses as a fuel the reformed gas which comes to reform original fuels, such as a methanol, especially has various kinds of advantages, such as excelling in system efficiency, development of the power-source system using this type of fuel cell is demanded.

[0004]

[Problem(s) to be Solved by the Invention] By the way, since the power-source system containing the above fuel cells will be in halt / storage condition to the temperature according to the temperature of an operating environment, it may fall to the freezing temperature of the cooling medium especially adopted as the power-source system as the operating environment is a cold district region. In such a case, a power-source system may damage and deteriorate by freezing of a cooling medium etc.

[0005] On the other hand, various techniques for keeping a fuel cell warm and preventing freezing conventionally, are proposed. For example, in JP,7-169475,A, when the temperature within the body of a fuel cell is judged with a temperature selector and a temperature fall is produced, without using an external power, the method of keeping a fuel cell warm, without using an external power by burning a original fuel with a catalyzed combustion vessel is indicated. Moreover, in JP,11-214025,A, an OAT is judged with a control unit, when an OAT falls, a fuel cell is started automatically, and the equipment which adopted the approach of preventing freezing of cooling water using generation of heat at the time of the generating mode of the body of a fuel cell is indicated.

[0006] However, sufficient effectiveness cannot be acquired when such a conventional incubation technique is applied to the power-source system using the fuel cell which uses reformed gas as a fuel. First, the approach of the actuation dependability of the incubation function of keeping a fuel cell warm, without using an external power which was indicated by JP,7-169475,A is inadequate when the catalyzed combustion machine for incubation must be added. Moreover, since it is the approach of keeping only the body of a fuel cell warm, it is difficult to keep the whole fuel cell equipment warm by this approach.

[0007] By the approach of, making operational status a fuel cell which was indicated by JP,11-214025,A on the other hand, and keeping it warm, the balance control of processing of a heating value required for incubation and generated energy becomes complicated. Moreover, this type of the system configuration and the principle of operation of a power-source system completely differ from the power-source system using the fuel cell which uses reformed gas as a fuel about the power-source system using the fuel cell with which this approach uses hydrogen gas as a fuel. Therefore, applying the approach indicated by this official report to the latter power-source system by which fields differ itself has unreasonableness.

[0008] This invention is preventing degradation and breakage of the system by freezing of a cooling medium etc., and offering the reliable power source system which can shorten warm-up time and can be start certainly, when it is propose in order to solve the trouble of the above conventional techniques, and the purpose gives the automatic incubation function of the fuel cell equipment under shutdown and storage of a system.

[0009]

[Means for Solving the Problem] The automatic incubation function under shutdown or storage is realized by this invention's checking the temperature in fuel cell equipment automatically, and operating auxiliary machinery equipments, such as the existing pumps and heating apparatus, according to the measured temperature.

[0010] the power-source system concerning invention of claim 1 -- the body of a fuel cell, and a original fuel -- reforming -- with reformed gas generation / supply network reformed with a reforming vessel using service water An air supply network, the cooling water network which circulates cell cooling water, and the auxiliary machinery equipment for supply / circulation formed in each network, In the power-source system equipped with the fuel cell equipment which has the auxiliary machinery equipment for heating formed in said reformed gas generation / supply network and the cooling water network, and a power source for auxiliary machinery equipments, and a dc-battery (rechargeable battery) as a power source, it is characterized by having a thermometric element, and a monitor and a control unit.

[0011] Here, in halt / storage condition of a power-source system, a thermometric element is constituted so that the temperature of the body of a fuel cell and cell cooling water may be checked automatically at least. Moreover, a monitor and a control unit are equipment which takes out a command to the power source for auxiliary-machinery equipments so that the signal from a thermometric element may be received, the auxiliary-machinery equipment according to the object which requires incubation of the auxiliary-machinery equipment for supply / circulation and the auxiliary-machinery equipment for heating when the measured value obtained from this signal becomes the temperature which requires incubation may be operated and an incubation function may be operated.

[0012] In this power-source system, a monitor and a control unit receive the signal of the thermometric element which supervises the temperature of the body of a fuel cell which has fear of freezing during the shutdown of a system, or storage, or its cell cooling water, and when measured value becomes the reference temperature set up beforehand, it takes out a command to the power source for auxiliary machinery equipments. By this command, the auxiliary machinery equipment for heating of the auxiliary machinery equipment for supply / circulation of a fuel feed pump, a cooling water circulating pump, the blower for air supply, etc., the heating apparatus of cell cooling water, etc. can be started, cooling water can be warmed, and the body of a fuel cell can be warmed with this warmed cooling water. Therefore, since the automatic incubation function of the fuel cell equipment under shutdown or storage can be given, degradation and breakage of the system by freezing of cooling water etc. can be prevented.

[0013] The power-source system concerning invention of claim 2 is set to the power-source system of claim 1. It has the water tank which stores service water according to an individual. the fuel tank in which reformed gas generation / supply network stores a original fuel, and reforming -- a original fuel and reforming -- it constitutes so that service water may be supplied to a reforming machine according to an individual -- having -- a thermometric element -- the temperature of the body of a fuel cell, and cell cooling water -- adding -- a reforming machine and reforming -- it is characterized by being constituted so that it may check automatically also about the temperature of service water.

[0014] the temperature of the body of a fuel cell with which a monitor and a control unit have fear of freezing during the shutdown of a system, or storage in this power-source system, or its cell cooling water -- in addition, the reforming machine which has fear of freezing similarly and reforming -- the signal of the thermometric element which supervises the temperature of service water receives, and when measured value becomes the reference temperature set up beforehand, a command takes out to the power source for auxiliary-machinery equipments. this command -- a fuel feed pump, a cooling water circulating pump and the blower for air supply, the heating apparatus of cell cooling water, etc. -- in addition -- while starting the heating apparatus of a reforming machine etc. and warming cooling water and the body of a fuel cell -- a reforming machine and reforming -- service water can be warmed. therefore, a reforming machine and reforming -- also when fear of freezing is in service water, these can be warmed certainly and sufficient automatic incubation function for fuel cell equipment can be given.

[0015] a means by which, as for the power-source system concerning invention of claim 3, reformed gas generation / supply network stores a original fuel in the power-source system of claim 1, and reforming -- it

has the composite fuel storage tank which unified a means to store service water, and a composite fuel storage tank is characterized by forming independently the storage tank of the fuel for incubation for supplying the auxiliary machinery equipment for heating.

[0016] the case where a fuel tank and a water tank are prepared according to an individual in this power-source system -- comparing -- original fuels, such as a methanol, and reforming -- a possibility that mixed liquor may freeze also in a cold district region since mixed liquor with service water is used and freezing temperature can be made low enough according to that mixing ratio -- there is nothing -- a reforming machine and reforming -- incubation of service water becomes unnecessary. On the other hand, since the fuel for incubation can be supplied to the auxiliary machinery equipment for heating, the body of a fuel cell and its cell cooling water can be warmed certainly, and sufficient automatic incubation function for fuel cell equipment can be given like the power-source system of claim 2.

[0017] The power-source system concerning invention of claim 4 is characterized by making a dc-battery serve a double purpose as a power source for auxiliary machinery equipments in the power-source system of any 1 term of claims 1-3. In this power-source system, the dc-battery which works as a power source for auxiliary machinery equipments can realize an incubation function independently, without needing an external power.

[0018] In the power-source system of claim 4, the power-source system concerning invention of claim 5 has the starting system which starts a power-source system automatically, and the remaining capacity monitor which supervises the remaining capacity of a dc-battery, and is characterized by constituting a monitor and a control unit as follows. That is, a monitor and a control unit receive the signal from a remaining capacity monitor, and by taking out a command to starting system, it operates this starting system, makes fuel cell equipment a generation-of-electrical-energy condition, and when the remaining capacity obtained from this signal changes into an insufficient condition, it is constituted so that a dc-battery may be made to charge.

[0019] In this power-source system, even if it does not give big allowances to power resource, without needing an external power, when the remaining capacity of a dc-battery will be in an insufficient condition, fuel cell equipment can be made to be able to generate automatically and a dc-battery can be charged. Therefore, without being restrained by power resource, it can continue at a long period of time, and an automatic incubation function can be maintained.

[0020] In the power-source system of any 1 term of claims 1-5, as for the power-source system concerning invention of claim 6, a monitor and a control unit are usually characterized by having the function which can be changed to either of the incubation stop modes to which an incubation function does not operate in halt / storage condition of a power-source system, and to which stop mode and an incubation function operate automatically. In this power-source system, when there are no worries about freezing, useless actuation of an incubation function can be prevented by usually making it stop mode. Therefore, consumption of the useless power accompanying useless actuation of an incubation function can be prevented.

[0021] The power-source system concerning invention of claim 7 is characterized by a cooling water network having a combustion burner as auxiliary machinery equipment for heating in the power-source system of any 1 term of claims 1-6. In this power-source system, since the power consumption which actuation of an incubation function takes is reducible as much as possible, an incubation function is maintainable by little power consumption for a long time.

[0022] The power-source system concerning invention of claim 8 is characterized by a cooling water network having an electric heater as auxiliary machinery equipment for heating in the power-source system of any 1 term of claims 1-6. In this power-source system, although the power of an external power is consumed compared with the power-source system of claim 7, the same incubation function is obtained.

[0023] The power-source system concerning invention of claim 9 is characterized by using a source power supply as a power source for auxiliary machinery equipments in the power-source system of any 1 term of claims 1-8. In this power-source system, without being restrained by the capacity of a dc-battery, with the power from a source power supply, it can continue at a long period of time, and an automatic incubation function can be maintained with high dependability.

[0024]

[Embodiment of the Invention] [1. Gestalt] of the 1st operation

The gestalt of the suitable operation in the hybrid power-source system which consists of the fuel cell equipment and the dc-battery of this invention is explained below to [the configuration of the whole 1-1. power-source system] with reference to drawing 1 and drawing 2 at a detail. First, drawing 1 is the block diagram showing the outline of a configuration of having connected the power-source system equipped with fuel cell equipment and a dc-battery as a power source to load equipments, such as an electric vehicle.

[0025] As shown in this drawing 1, in addition to the fuel cell equipment 1 and the dc-battery 2 which work as a power source, the power-source system of the gestalt of this operation is using a monitor and a control device 3, relay 4, starting system 5, the remaining capacity monitor 6, and the switch 7 as the main components, and the load equipments 8, such as an electric vehicle, are connected to this power-source system. Below, sequential explanation is given about each component and load equipment of this power-source system.

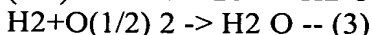
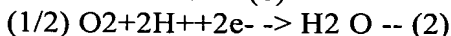
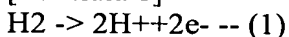
[0026] Connection of fuel cell equipment 1 is respectively attained with a dc-battery (rechargeable battery) 2 and load equipment 8 through the switch 7 or the relay 4. According to such a connection condition of a circuit, fuel cell equipment 1 charges a dc-battery 2, or drives load equipment 8.

[0027] A dc-battery 2 is a power unit which supplies power to load equipment 8 with fuel cell equipment 1. With the gestalt of this operation, although the lithium dc-battery was used, rechargeable batteries of other type, such as a nickel-hydrogen battery and a lead accumulator, can also be used. Since this dc-battery 2 needs to work as a main power source which drives load equipment 8 at the time of starting of a power-source system so that it may mention later, the capacity of a dc-battery 2 is what gave predetermined allowances based on the service condition expected.

[0028] Load equipment 8 generates driving force in response to supply of the power from fuel cell equipment 1 or a dc-battery 2. This driving force is told to the front wheel and/or rear wheel of a car through the axle in the car carrying for example, a power-source system, and turns into driving force which makes it run a car. This load equipment 8 receives control of a monitor and a control unit 3. A monitor and a control unit 3 take out a command to load equipment 4 according to an operator's load command, and the signal for [as a command] carrying out load operation is exchanged.

[0029] [Configuration of 1-2. fuel cell equipment] drawing 2 is the block diagram showing the configuration of the fuel cell equipment 1 of drawing 1. First, the body 11 of a fuel cell which constitutes fuel cell equipment 1 is the fuel cell of a solid-state polyelectrolyte mold, and has the stack structure which carried out two or more laminatings of the single cel which is a configuration unit. This body 1 of a fuel cell receives supply of the fuel gas containing hydrogen in a negative-electrode side, and electromotive force is acquired according to the electrochemical reaction shown below in response to supply of the oxidation gas containing oxygen to a positive-electrode side.

[Formula 1]



In (1) type, the anode electrode reaction by the side of a negative electrode and (2) types show the cathode electrode reaction by the side of a positive electrode here, respectively, and (3) types express the reaction which occurs by the whole cell.

[0030] This fuel cell equipment 1 equips auxiliary machinery equipment, and a monitor and control units 3, such as the cooling water network 14 which makes reformed gas generation / supply network 12 for supplying reformed gas to the body 11 of a fuel cell, and the body 11 of a fuel cell, and the body 11 of a fuel cell circulate through the air supply network 13 for supplying air, and the cooling water for body of fuel cell 11 first as main components, and pumps, with the power-source 15 grade for auxiliary machinery equipments which supplies power. and this fuel cell equipment 1 -- these components -- in addition, it has two or more thermometric elements 16-19 arranged according to this invention, and is supervised and controlled by the monitor and the control unit 3 mentioned above based on the signal from these thermometric elements 16-19. Below, sequential explanation is given about the configuration of each part.

[0031] The body 11 of a fuel cell consists of a cooling room 23 with the passage which supplies the cooling water which has the function which discharges outside the anode (negative electrode) 21 with the passage which supplies hydrogen content gas, the cathode (positive electrode) 22 with the passage which supplies the air containing oxidation gas, and the heat produced at the above-mentioned reaction.

[0032] the reforming machine 30 in which reformed gas generation / supply network 12 supplies original fuel gas and water via an evaporator (not shown), respectively, and has the burner 29 for reforming machine heating by a fuel tank 24 and the water tank 26 which has the heating apparatus 25 for water tanks to a fuel feed pump 27 and the water feed pump 28 -- setting -- hydrogen -- rich fuel gas -- generating -- this hydrogen -- rich fuel gas is supplied to the anode 21 of the body 11 of a fuel cell. The air supply network 13 is equipped with the blower 31, and supplies air to the cathode 22 of the body 11 of a fuel cell by this blower 31.

[0033] The cooling water network 14 is equipped with the cooling water accumulator 32, the cooling water

circulating pump 33, and the cooling water heat exchanger 34 sequentially from the outflow of cooling water of the body 11 of a fuel cell. Here, the cooling water heat exchanger 34 is equipped with the burner 36 for cooling water heating which has the radiator 35 which has the function which lowers temperature, and the function which raises temperature, and controls the temperature of the cooling water supplied to the body 11 of a fuel cell using these radiators 35 and the burner 36 for cooling water heating. The power source 15 for auxiliary machinery equipments supplies power under control by the monitor and the control device 3 to the pumps, and a monitor and a control device 3 of a fuel feed pump 27, the cooling water circulating pump 33, and blower 31 grade. This power source 15 for auxiliary machinery equipments is a source power supply.

[0034] Among two or more thermometric elements 16-19, a thermometric element 16 is a cooling water thermometric element which detects the circulating water temperature of the cooling water accumulator 32, and a thermometric element 17 is a cell thermometric element which detects the temperature of the body 11 of a fuel cell. Moreover, a thermometric element 18 is a reforming machine thermometric element which detects the temperature of the reforming machine 30, and a thermometric element 19 is a water tank thermometric element which detects the temperature of a water tank 26.

[0035] On the other hand, in reformed gas generation / supply network 12, the 1st closing motion valve 37 for fuels is formed on Rhine which supplies original fuel gas to the reforming machine 30 with a fuel feed pump 27 from a fuel tank 24. In addition, Rhine which supplies original fuel gas is also established in the burner 36 for cooling water heating of the cooling water heat exchanger 34 with the fuel feed pump 27, and the 2nd closing motion valve 38 for fuels is formed on this Rhine.

[0036] Moreover, in the air supply network 13, the 1st closing motion valve 39 for air is formed on Rhine which supplies air to the cathode 22 of the body 11 of a fuel cell by the blower 31. In addition, Rhine which supplies air is also established in the burner 36 for cooling water heating of the cooling water heat exchanger 34 by the blower 31, and the 2nd closing motion valve 40 for air is formed on this Rhine.

[0037] In addition, although not illustrated from a viewpoint of simplification of a drawing, in reformed gas generation / supply network 12 and the air supply network 13, Rhine which supplies original fuel gas and air to the above burners 36 for cooling water heating, and Rhine which supplies original fuel gas and air to the burner 29 for reforming machine heating similarly are also established, and the same closing motion valve is prepared in each Rhine at them.

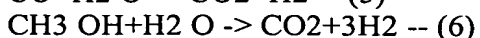
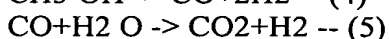
[0038] And after the combustion gas of the burner 36 for cooling water heating or the burner 29 for reforming machine heating is sent to the heating apparatus 25 for water tanks and warms the water in a water tank 26 by this heating apparatus 25 for water tanks, it is emitted into atmospheric air again.

[0039] On the other hand, a monitor and a control unit 3 have functions, such as an operation control function, an incubation function, an auto-boot function, and a stop mode change function, as shown in drawing 2. First, in the fuel cell equipment 1 shown in drawing 2, although an output is controllable according to the magnitude of the load connected by adjusting the amount of air supply which are the fuel gas amount of supply and oxidation gas, the monitor and the control unit 3 have the operation control function which performs such an output control. That is, a monitor and a control unit 3 take out a command to the power source 15 for auxiliary machinery equipments according to the magnitude of the load connected, and performs the output control of fuel cell equipment 1 for a fuel feed pump 27 and a blower 31 starting and a halt, or by carrying out an output control.

[0040] Moreover, an incubation function is realized by a monitor and a control unit 3 taking out a command to the power source 15 for auxiliary machinery equipments if needed as compared with the reference temperature beforehand set up in the measured value obtained with thermometric elements 16-19, and controlling starting and halt or output of pumps 27, 31, and 33 and the closing motion valves 37-40, and opening.

[0041] In [1-3. reforming reaction] drawing 2, the methanol is prepared for the fuel tank 24 and the reforming machine 30 receives supply of a methanol and water from a fuel tank 24 and a water tank 26. and reforming according [using the supplied methanol as a original fuel in the reforming machine 30] to a steam reforming process -- carrying out -- hydrogen -- rich fuel gas is generated. Below, the reforming reaction performed in the reforming machine 30 interior is shown.

[Formula 2]



[0042] The conversion reaction of the carbon monoxide expressed with the decomposition reaction of the

methanol by which the reforming reaction of a methanol performed with the reforming vessel 30 is expressed with (4) types, and (5) types advances to coincidence, and the reaction of (6) types occurs as a whole. Such a reforming reaction is endothermic reaction as a whole. the hydrogen generated with the reforming vessel 30 -- rich fuel gas is supplied to the body 11 of a fuel cell through a fuel-supply way, and is supplied to an anode in each ** cel, and the anode electrode reaction shown in (1) type is presented with it. [0043] On the other hand, a blower 31 supplies the air incorporated from the outside to the body 11 of a fuel cell. In each ** cel within the body 11 of a fuel cell, this air is supplied to a cathode and the cathode electrode reaction shown in (2) types is presented with it.

[0044] In addition, a single cel here means the generation-of-electrical-energy component of the smallest unit which pinched film of solid-state macromolecule ion conductivity like the Du Pont "Nafion" film between the anode electrode and the cathode electrode. The body 11 of a fuel cell carries out the a large number laminating of this single cel through the separator which has a fuel and the supply way of air, respectively, and is constituted. The cooling room is installed for every cel and every number cel. Thus, in fact, although the body 11 of a fuel cell carries out the laminating of a majority of single cels [many] and is constituted, it shows the body 11 of a fuel cell typically from a viewpoint of simplification of a drawing in drawing 2 .

[0045] Moreover, as mentioned already, the reforming reaction in the reforming machine 30 is endothermic reaction, and since supply of heat is required, the burner 29 for reforming machine heating is formed in the interior of the reforming machine 30 from the exterior. Fuel exhaust gas after being used by the anode electrode reaction within the body 11 of a fuel cell, and air exhaust gas after being supplied by the blower 31 and used by cathode electrode reaction are supplied, it is used for combustion and a heating value required for a reforming reaction is supplied to this burner 29 for reforming machine heating.

[0046] The operation of the power-source system concerning the gestalt of [1-4. operation] book operation is as follows. First, the monitor and the control unit 3 are always maintained by the control state with the power from the power source 15 for auxiliary machinery equipments at the time of shutdown and storage of a power-source system. In this condition, even if there are few the cooling water thermometric element 16, cell thermometric elements 17, reforming machine thermometric elements 18, and water tank thermometric elements 19, any one signal is received. When the reference temperature to which the measured value is set beforehand is approached, while a monitor and a control unit 3 take out a command to the power source 15 for auxiliary machinery equipments and operating a fuel feed pump 27, the cooling water circulating pump 33, and a blower 31, the closing motion valve to which the closing motion valve 37 - 40 grades relate is made to open and close.

[0047] In this case, it closes, and the 2nd closing motion valve 38 for fuels serves as open, and the 1st closing motion valve 39 for air is closed, and the 2nd closing motion valve 40 for air serves as open, consequently a fuel and air are supplied to the burner 36 for cooling water heating, respectively, and the 1st closing motion valve 37 for fuels is lit with the automatic ignition which is not illustrated. In this way, the cooling water supplied to the cooling room 23 of the body 11 of a fuel cell by the cooling water heat exchanger 34 is warmed, it is again recycled by the cooling water heat exchanger 34 with the cooling water circulating pump 33 through the cooling water accumulator 32, and the cooling water network 14 whole including the body 11 of a fuel cell is warmed.

[0048] Similarly, a fuel and air are supplied also to the burner 29 for reforming machine heating by disconnection of the closing motion valve which is not illustrated, respectively, and the reforming machine 30 is warmed by it. Furthermore, after the combustion gas of the burner 36 for cooling water heating and the burner 29 for reforming machine heating is sent to the heating apparatus 25 for water tanks and warms the water in a water tank 26, it is emitted into atmospheric air.

[0049] And desirably, the reference temperature to which the measured value obtained with thermometric elements 16-19 was set beforehand, and when (freezing temperature) +5 degree C is reached, the closing motion valve which constitutes the supply line for incubation while a fuel feed pump 27, the cooling water circulating pump 33, and a blower 31 stop closes by the command of a monitor and a control device 3, and an incubation function stops by this.

[0050] According to the gestalt of [1-5. effectiveness] book operation, the water in the water in the cooling water network 14 including the cooling room 23 of the body 11 of a fuel cell, the reforming machine 30 in reformed gas generation / supply network 12, and a water tank 26 is always maintained by the automatic incubation function in which it explained above, more than freezing temperature. Therefore, degradation and breakage of the system by freezing can be prevented, and warm-up time can also be shortened, and further, since it is specifically maintained by 0 degrees C or more more than freezing temperature, a power-source

system can be started certainly.

[0051] [2. Gestalt] of the 2nd operation

[2-1. configuration] drawing 3 is the block diagram concerning this invention showing another configuration of the fuel cell equipment 1 of drawing 1 as a gestalt of the 2nd operation. As shown in this drawing 3, the gestalt of this operation unifies the fuel tank 24 and the water tank 26 in a gestalt of the 1st operation which were mentioned above, and uses them as one water composite-fuel tank 41, it considers as the configuration which stores the water composite fuel which comes to mix water with a original fuel beforehand in this water composite fuel tank 41, and the fuel tank 42 for incubation in which the fuel for incubation is stored is formed further independently. In this case, the mixture of methanol-water is stored in the water composite fuel tank 41, using a methanol as a original fuel. In addition, about other parts, it considers as the same configuration as the gestalt of the 1st operation.

[0052] The operation of the gestalt of a 2-2. operation and [effectiveness] book implementation is as follows. first, at the time of the usual operation of a power-source system, water composite fuel supplies the reforming machine 30 by the water feed pump 28 from the water composite fuel tank 41 -- having -- hydrogen -- it becomes rich fuel gas and the body 11 of a fuel cell is supplied. On the other hand, at the time of shutdown and storage of a power-source system, to the burner 36 for cooling water heating of the cooling water network 14, a fuel is supplied if needed and the incubation function of the body 11 of a fuel cell and the cooling water network 14 is committed like the gestalt of the 1st operation from the fuel tank 42 for incubation.

[0053] by the way, the freezing temperature of the mixed liquor of a methanol and water is shown in drawing 4 -- as -- freezing point depression -- it is -- a methanol -- if it becomes 40% or more with a mixing ratio (weight ratio), freezing temperature will become less than [-40 degree C]. Since a methanol mixing weight ratio required for usual methanol reforming is 40% or more, freezing temperature becomes -40 degrees C or less, and incubation becomes unnecessary.

[0054] therefore, the thing for which the same effectiveness as the gestalt of the 1st operation is acquired according to the gestalt of this operation -- in addition, only the part from which the thermometric element function of the object for water tanks 26 which contains further the reforming machine thermometric element 18 used in the gestalt of the 1st operation and the water tank thermometric element 19, and the reforming machine 30, and the heating apparatus 25 for water tanks become unnecessary can simplify a configuration.

[0055] [3. In the power-source system of the gestalt of the 3rd operation, the dc-battery 2 concerning gestalt] this invention of the 3rd operation shown in drawing 1 is made to serve a double purpose as a power source 15 for auxiliary machinery equipments in the gestalt of the 1st operation mentioned above. In this power-source system, the dc-battery which works as a power source for auxiliary machinery equipments can realize an incubation function independently, without needing an external power further in addition to the same effectiveness as the gestalt of the 1st operation being acquired.

[0056] [4. Gestalt] of the 4th operation

The function concerning [4-1. configuration] this invention which was mentioned above in the power-source system of the gestalt of the 4th operation and which makes a monitor and a control device 3 put a power-source system into operation automatically in the gestalt of the 3rd operation according to the remaining capacity of a dc-battery 2 is given. That is, in the gestalt of this operation, a monitor and a control device 3 have the auto-boot function which this starting system 5 is operated and makes fuel cell equipment 1 a generation-of-electrical-energy condition by taking out a command to starting system 5 according to the signal of the remaining capacity monitor 6 of a dc-battery 2.

[0057] The operation of the gestalt of a 4-2. operation and [effectiveness] book implementation is as follows. First, it sets to incubation operation under power-source system stop. As well as the gestalt of the 1st operation even if there are few the cooling water thermometric element 16, cell thermometric elements 17, reforming machine thermometric elements 18, and water tank thermometric elements 19, any one signal is received. When the reference temperature set up beforehand is approached, while a monitor and a control unit 3 take out a command to the power source 15 for auxiliary machinery equipments and operating a fuel feed pump 27, the cooling water circulating pump 33, and a blower 31, the closing motion valve to which the closing motion valve 37 - 40 grades relate is made to open and close. Consequently, a fuel and air are supplied to the burner 36 for cooling water heating, and the burner 29 for reforming machine heating, respectively, and the cooling water network 14 whole including the body 11 of a fuel cell and the reforming machine 30 are warmed. Furthermore, the combustion gas of the burner 36 for cooling water heating and the burner 29 for reforming machine heating is sent to the heating apparatus 25 for water tanks, and warms the

water in a water tank 26.

[0058] And when the measured value obtained with thermometric elements 16-19 reaches the reference temperature set up beforehand, the closing motion valve which constitutes the supply line for incubation while a fuel feed pump 27, the cooling water circulating pump 33, and a blower 31 stop closes by the command of a monitor and a control device 3, and an incubation function stops by this.

[0059] On the other hand, at the time of actuation of such an incubation function, the power of the dc-battery 2 which is a power source for auxiliary machinery equipments is consumed by actuation of a monitor and a control device 3, a fuel feed pump 27, the cooling water circulating pump 33, and a blower 31. A monitor and a control device 3 receive the signal from the remaining capacity monitor 6, and when the value which the remaining capacity of a dc-battery 2 decreased and was set up beforehand is reached, a signal operates delivery and this starting system 5 to the starting system 5 of a power-source system automatically by that auto-boot function. Fuel cell equipment 1 will be in a starting condition like the case where an operator pushes the carbon button which operates starting system in this way.

[0060] Namely, auxiliary machinery equipments, such as a fuel feed pump 27, the water feed pump 28, a blower 31, and the cooling water circulating pump 33, are operated by using a dc-battery 2 as a power source with starting system 5. And in order to operate the burner 36 for cooling water heating, and the burner 29 for reforming machine heating, the closing motion valve which constitutes the Rhine for supply is opened, these burners 36 and 29 are burned, the temperature of the body 11 of a fuel cell is raised, and it changes into a generation-of-electrical-energy condition.

[0061] In this case, when it is in the condition that auxiliary machinery equipment and the load equipments 8, such as a fuel feed pump 27, the water feed pump 28, a blower 31, and the cooling water circulating pump 33, were separated, all the generated output of fuel cell equipment 1 is used for charge of a dc-battery 2. On the other hand, when it is in the condition that the incubation function is operating, fuel cell equipment 1 commits the fuel feed pump 27 which maintains an incubation function, the cooling water circulating pump 33, and the auxiliary machinery equipment of blower 31 grade also as a power source which operates. In this case, the switch 7 between fuel cell equipment 1 and a dc-battery 2 will be connected too hastily, by operating the generation-of-electrical-energy electrical potential difference of fuel cell equipment 1 as more than the electrical potential difference set up beforehand, a condition higher than the electrical potential difference of a dc-battery 2 can be maintained, and a dc-battery 2 is charged as a result. In this way, a dc-battery 2 will be in a charge condition, consuming the fuel in a fuel tank 24.

[0062] Consequently, a dc-battery 2 is always maintained by the charge condition more than the remaining capacity of a constant rate, and a power-source system is maintained more than freezing temperature, and the condition that it can start at any time is secured. Moreover, if a dc-battery 2 carries out the completion of charge, actuation contrary to the above-mentioned actuation will progress, and fuel cell equipment 1 will stop automatically.

[0063] Thus, even if it does not give big allowances to dc-battery 2 capacity, without needing [according to the gestalt of this operation] an external power in addition to the same effectiveness as the gestalt of the 1st operation being acquired, when the remaining capacity of a dc-battery 2 will be in an insufficient condition, fuel cell equipment 1 can be made to be able to generate automatically, and a dc-battery 2 can be charged. Therefore, without being restrained by the capacity of a dc-battery 2, it can continue at a long period of time, and an automatic incubation function can be maintained.

[0064] [5. In the power-source system of the gestalt of the 5th operation, as stop mode in the gestalt of the 1st operation concerning gestalt] this invention of the 5th operation mentioned above, it usually has two kinds of modes, stop mode and incubation stop mode, and an operation operator considers as a switchable configuration artificially with a changeover switch at the time of shutdown. That is, by stop mode, an incubation function does not operate but it usually considers as the configuration in which an incubation function operates only at the time of incubation stop mode.

[0065] In this power-source system, when there are no worries about freezing, useless actuation of an incubation function can be prevented by usually making it stop mode. Therefore, in addition to the same effectiveness as the gestalt of the 1st operation being acquired, consumption of the useless power accompanying useless actuation of an incubation function can be prevented further, and the power consumption by the monitor and the control unit 3 can be controlled to the minimum.

[0066] [6. In the power-source system of the gestalt of the 6th operation, it considers as the configuration which transposed the burner 36 for cooling water heating of the cooling water network 14 to the electric heater concerning gestalt] this invention of the 6th operation which was mentioned above, and which uses a source power supply in the gestalt of the 1st operation. In this power-source system, although the power of

an external power is consumed, the same incubation function as the gestalt of the 1st operation is obtained. [0067] The gestalt of two or more operations which is not limited to the gestalt of the operation which mentioned this invention above which is [a gestalt of operation of others [. / 7]], could carry out modifications various otherwise within the limits of this invention, and was mentioned above can be combined freely. For example, it is possible to combine each of the gestalt of the 3rd - the 6th operation with the gestalt of the 2nd operation etc., and the same effectiveness is acquired also in such a case.

[0068] Moreover, the concrete configuration of the thermometric element which is the important component of this invention, or a monitor and a control unit is freely selectable as long as an automatic incubation function which was mentioned above is realizable. Furthermore, it is freely selectable also about the concrete configuration of each part, such as a concrete configuration of the power-source system containing fuel cell equipment or a dc-battery, and a body of a fuel cell in fuel cell equipment, reformed gas generation / supply network, an air supply network, a cooling water network. That is, this invention can be applied like the general power-source system equipped with the fuel cell equipment and the dc-battery of the type which uses reformed gas as a fuel as a power source, and the similarly excellent effectiveness is acquired.

[0069]

[Effect of the Invention] According to this invention the above passage, since the automatic incubation function of the fuel cell equipment under shutdown and storage of a system can be given, degradation and breakage of the system by freezing of a cooling medium etc. can be prevented, and the reliable power-source system which can shorten warm-up time and can be started certainly can be offered.

[Translation done.]

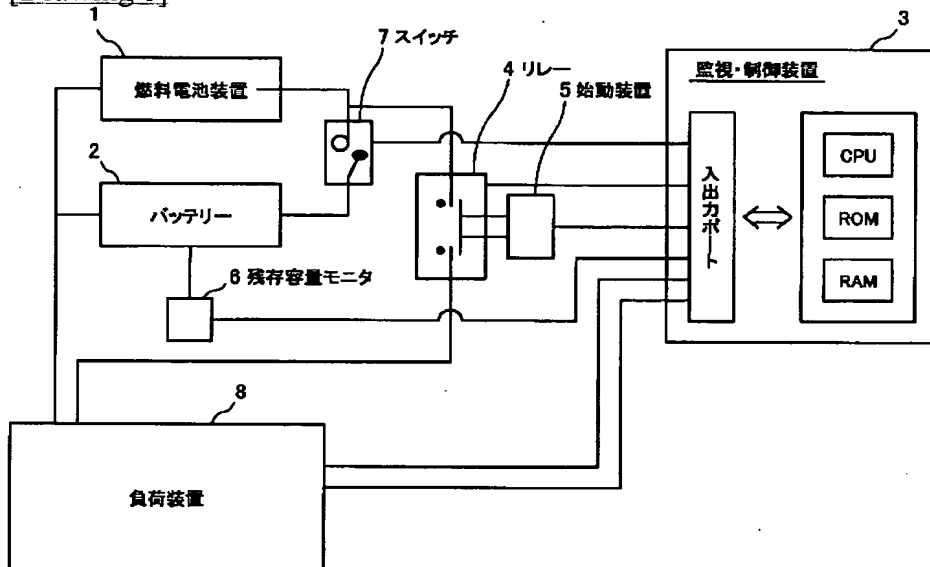
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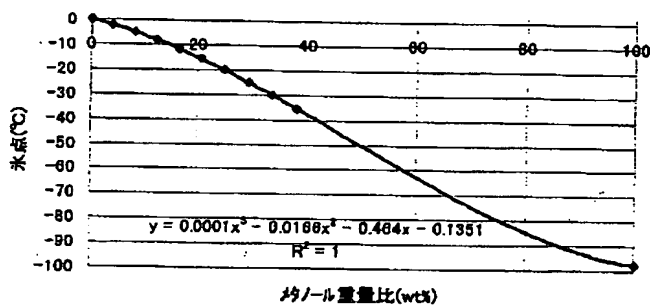
DRAWINGS

[Drawing 1]

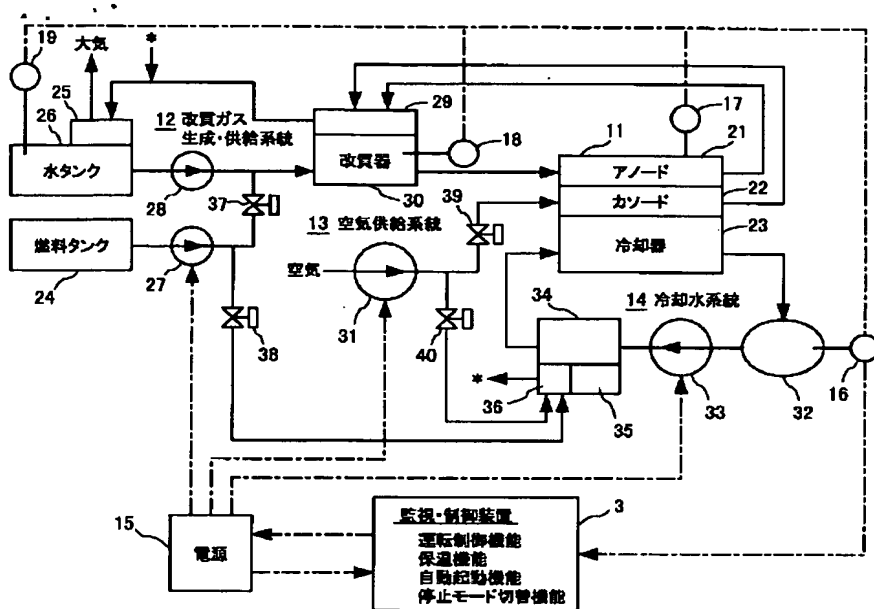


[Drawing 4]

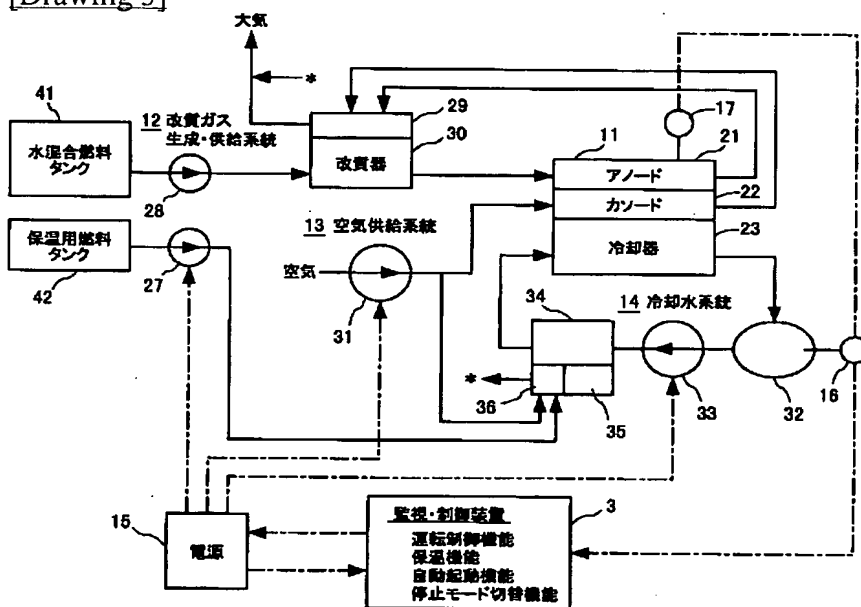
水-メタノール系の氷点



[Drawing 2]



[Drawing 3]



[Translation done.]